

# Modeling Deterioration of Running and Start Emissions in 1981-93 Light Duty Vehicles

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# Modeling Deterioration of Running and Start Emissions in 1981-93 Light Duty Vehicles

## Overview

- ◆ Methodology
- ◆ Data
- ◆ Outcomes

# Report References

- ◆ M6.STE.002, "The Determination of Hot Running Emissions from FTP Bag Emissions"
- ◆ M6.STE.003, "Determination of Start Emissions as a Function of Mileage and Soak Time for 1981-1993 Model Year Light-Duty Vehicles"
- ◆ M6.EXH.001, "Determination of Running Emissions as a Function of Mileage for 1981-1993 Model Year Light-Duty Cars and Trucks"
- ◆ M6.EXH.002, "Analysis of Emissions Deterioration Using Ohio and Wisconsin IM240 Data"
- ◆ M6.EXH.008 Overview of Methodology for Tier 0 In-Use Deterioration and Key Issues for Comment

# Purpose of Analysis

- ◆ Quantify changes in emissions with vehicle usage
- ◆ Provide MOBILE model with Basic Emission Rates (BERs)

# Overview of Methodology

- ◆ Running emissions
  - Piecewise linear fit of Running LA4 versus mileage, using FTP data
  - Adjusted for possible bias using IM 240 data
- ◆ Start emissions
  - Divided among normal and high emitters
  - Fraction of high emitters same as with running emissions

# Model year/technology groups

## Cars

88-93 PFI  
88-93 TBI  
86-93 CARB  
83-87 FI  
83-85 CARB  
81-82 FI  
81-82 CARB

## Trucks

88-93 PFI  
88-93 TBI  
84-93 CARB  
81-87 FI  
81-83 CARB

# Data - FTP

- ◆ EPA Emission Factors Database (n=3,208) - mostly pre-1990
- ◆ Manufacturers (n=2,256) - 1990-93 model years
- ◆ API (n=157) - high mileage 1981-93
- ◆ Representativeness questioned due to voluntary sampling

# Dayton, Ohio IM 240

- ◆ 181,018 from model years 1981-93
  - 142,044 cars
  - 38,974 trucks
- ◆ Considered more representative than FTP samples
- ◆ Unreliable odometer



# Wisconsin IM 240

- ◆ Random selection of vehicles for full 240 second test
- ◆ 3,206 cars and 1,193 trucks
- ◆ Used to predict full 240 second emissions from fast-pass

# Other Data

- ◆ Hammond/Phoenix
  - 938 tests of lane and lab IM240 matched with lab FTP
  - used to convert IM240 to LA4
- ◆ Hot Running 505
  - 77-car program to measure no-start condition
  - used to estimate running and start emissions from FTP bags

# Modeling Running Emissions

- ◆ Piecewise function
  - Constant emissions assumed at low mileage to account for inadequate data
  - Unconstrained linear function for high mileage
  - In a few cases, need to connect lines using linear function through low mileage point

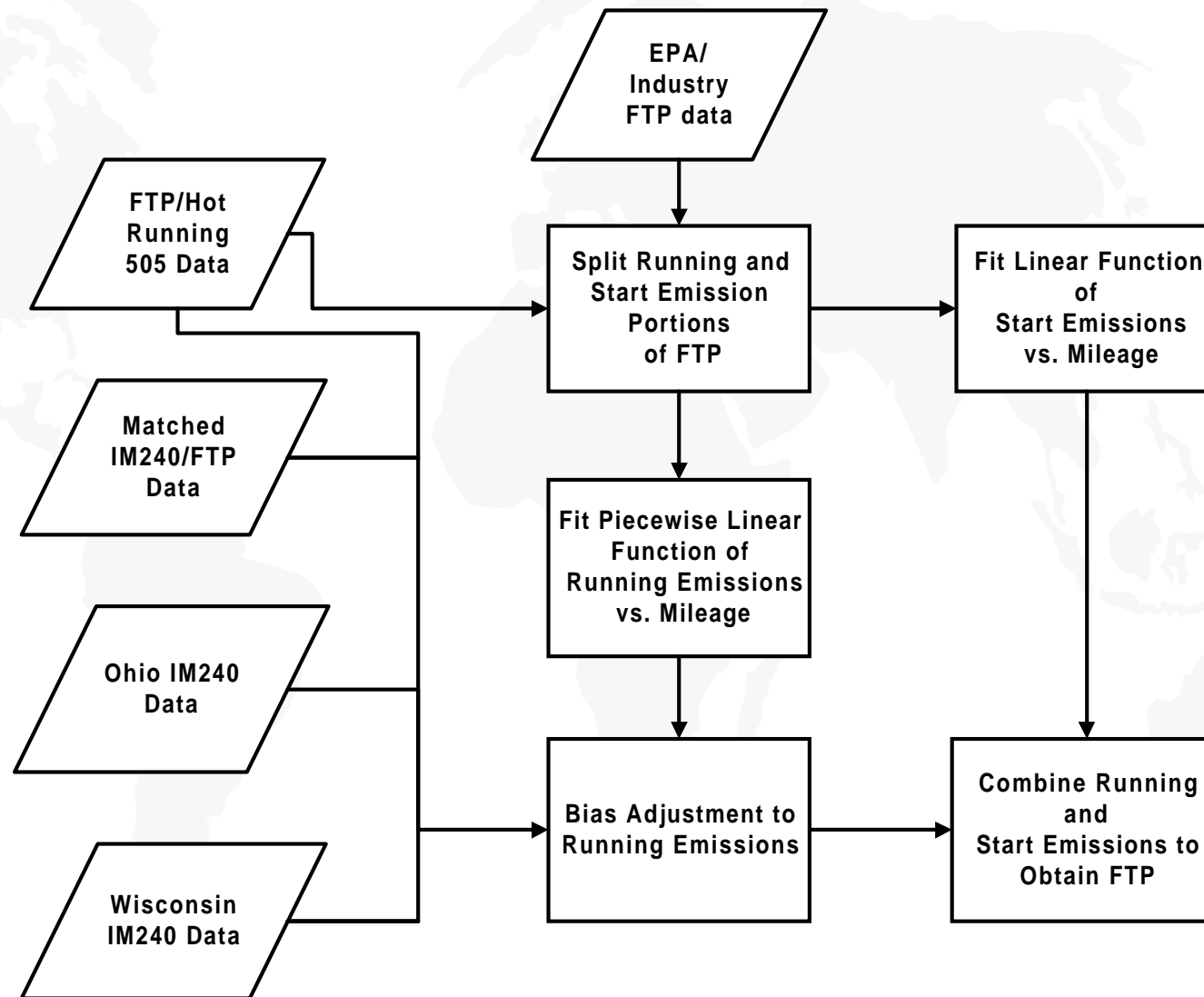
# Modeling Running Emissions

- ◆ Adjustment for possible bias
  - Convert fast-pass IM240 to Running LA4
  - Compute mean Running LA4 emissions by model year, vehicle type and fuel metering
  - Associate means with average mileage
  - Adjust FTP-based line to agree with means from larger, more representative sample
  - Additive adjustment factor linear with mileage

# Modeling Start Emissions

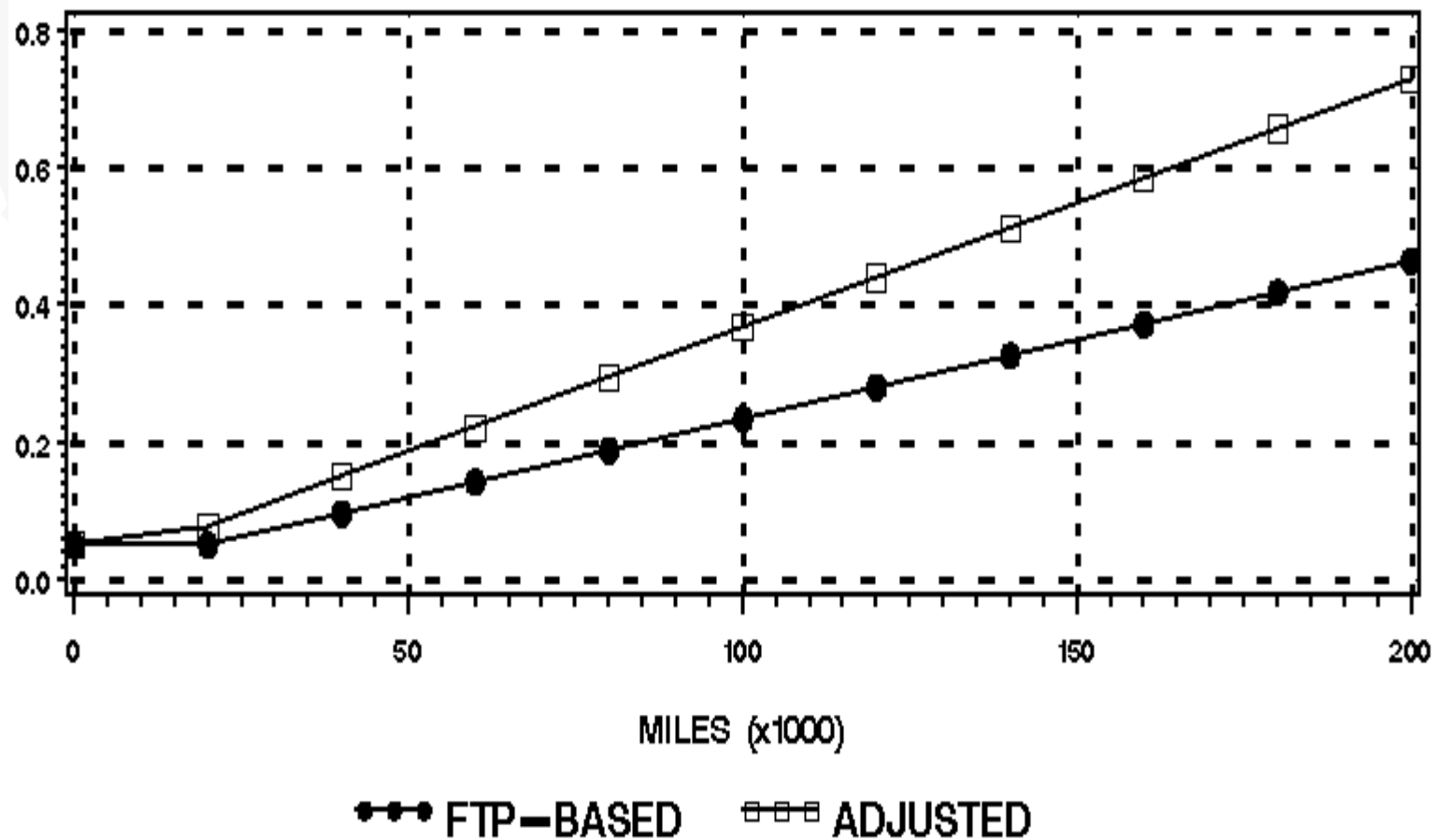
- ◆ Normals modeled as linear function of mileage
- ◆ For HC and CO highs constant
  - No NO<sub>x</sub> high emitters
- ◆ Percentage of high emitters at a given mileage equal to that of running emissions

# Fitting it Together



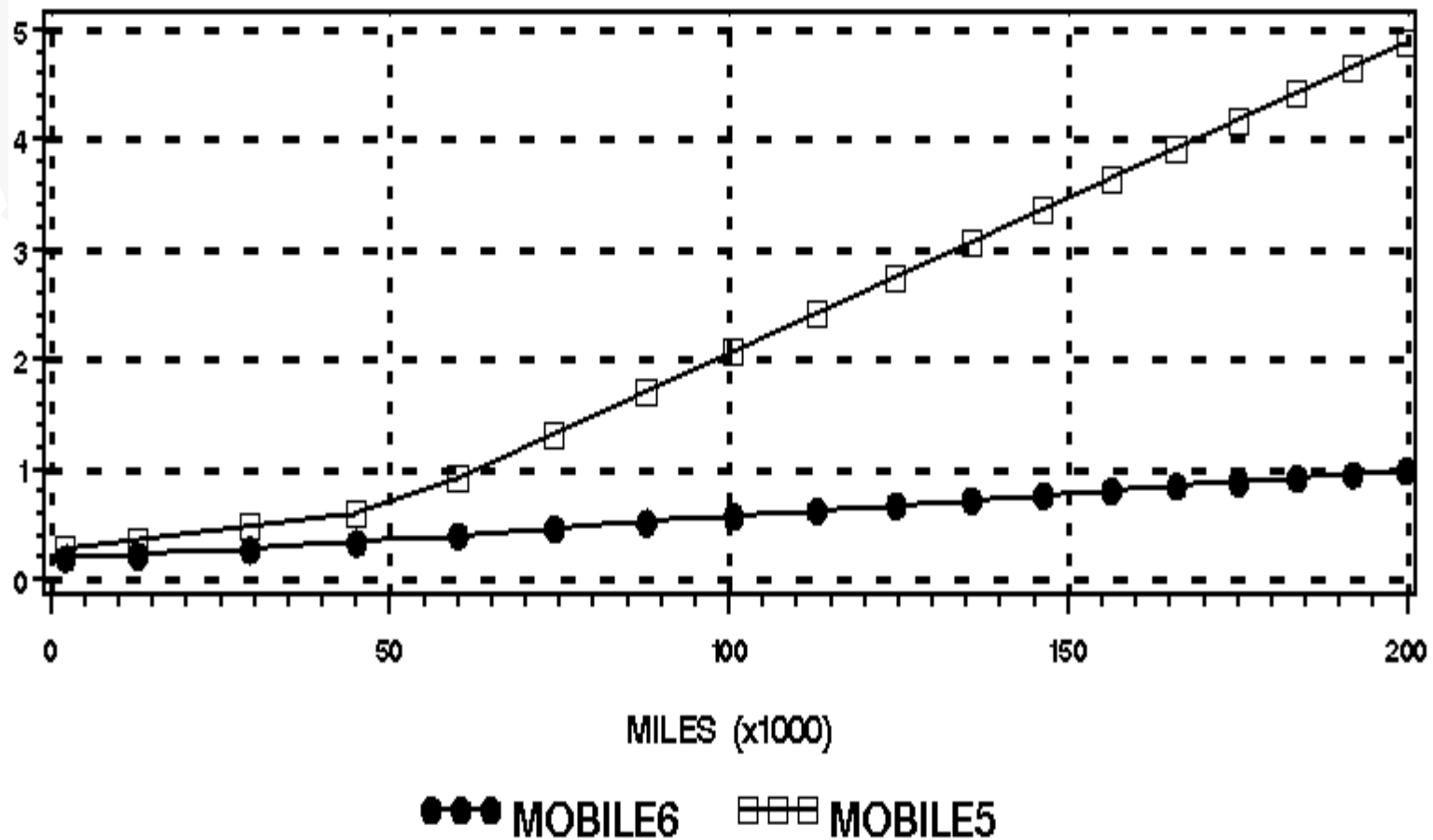
FTP-BASED MOBILE6 PROJECTIONS and OHIO IM240 ADJUSTMENTS  
RUNNING LA4, 1988-93 PFI CARS

HC (g/mi)



# FTP SPACE COMPARISON OF MOBILE5 and PROPOSED MOBILE6 HC EMISSION FACTORS — 1992 CARS

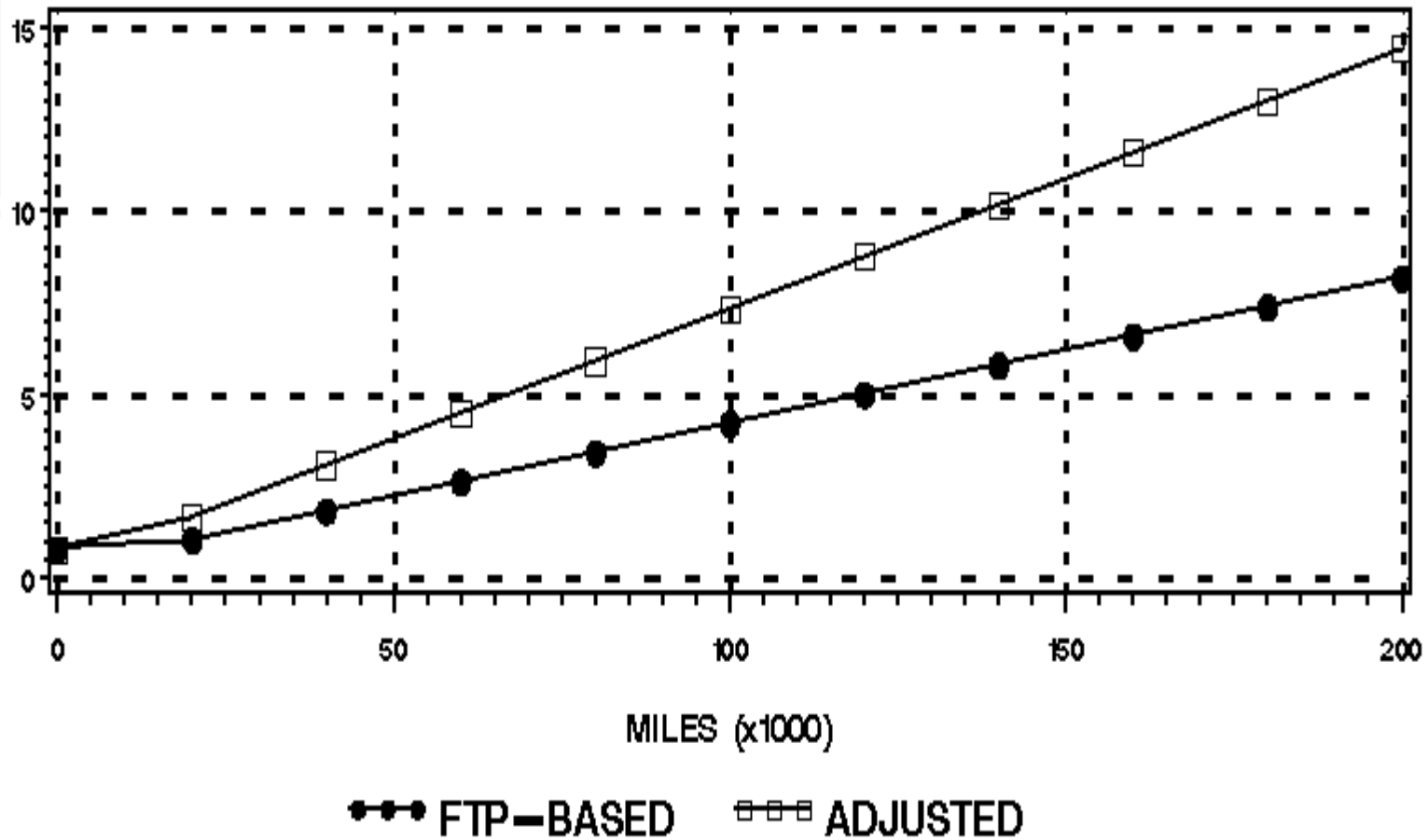
HC (g/mi)





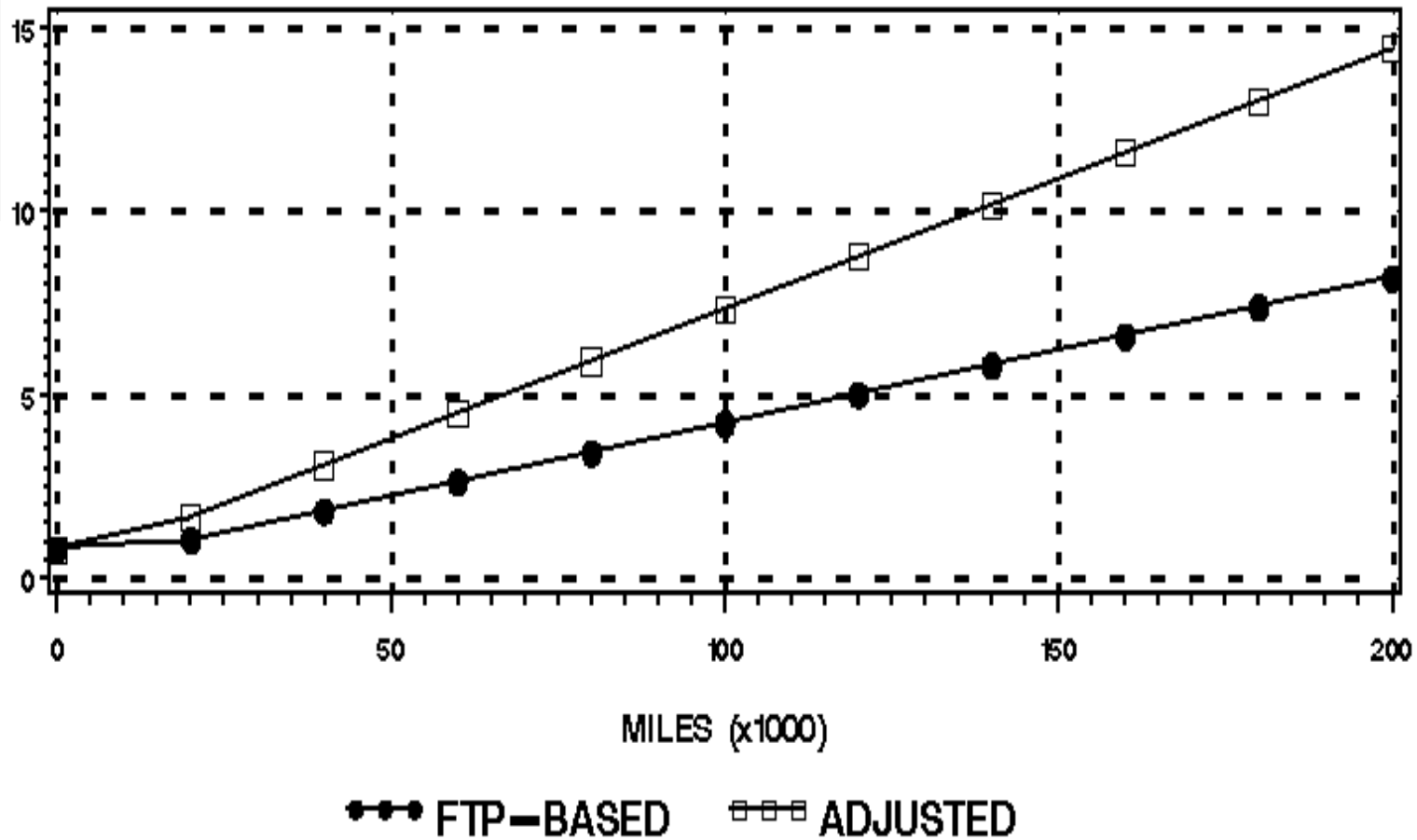
FTP-BASED MOBILE6 PROJECTIONS and OHIO IM240 ADJUSTMENTS  
RUNNING LA4 CO (g/mi), 1988-93 PFI CARS

CO (g/mi)



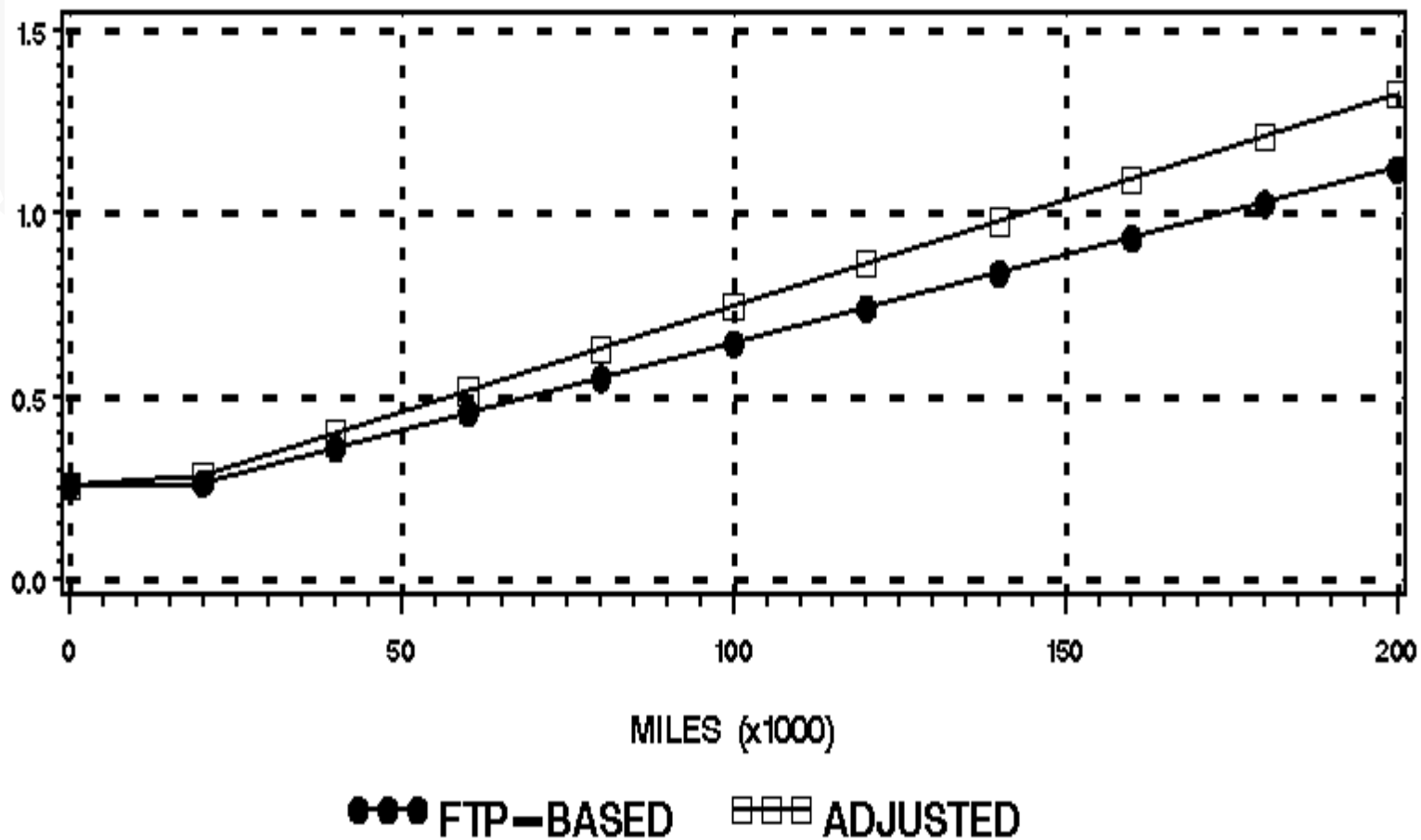
FTP-BASED MOBILE6 PROJECTIONS and OHIO IM240 ADJUSTMENTS  
RUNNING LA4 CO (g/mi), 1988-93 PFI CARS

CO (g/mi)



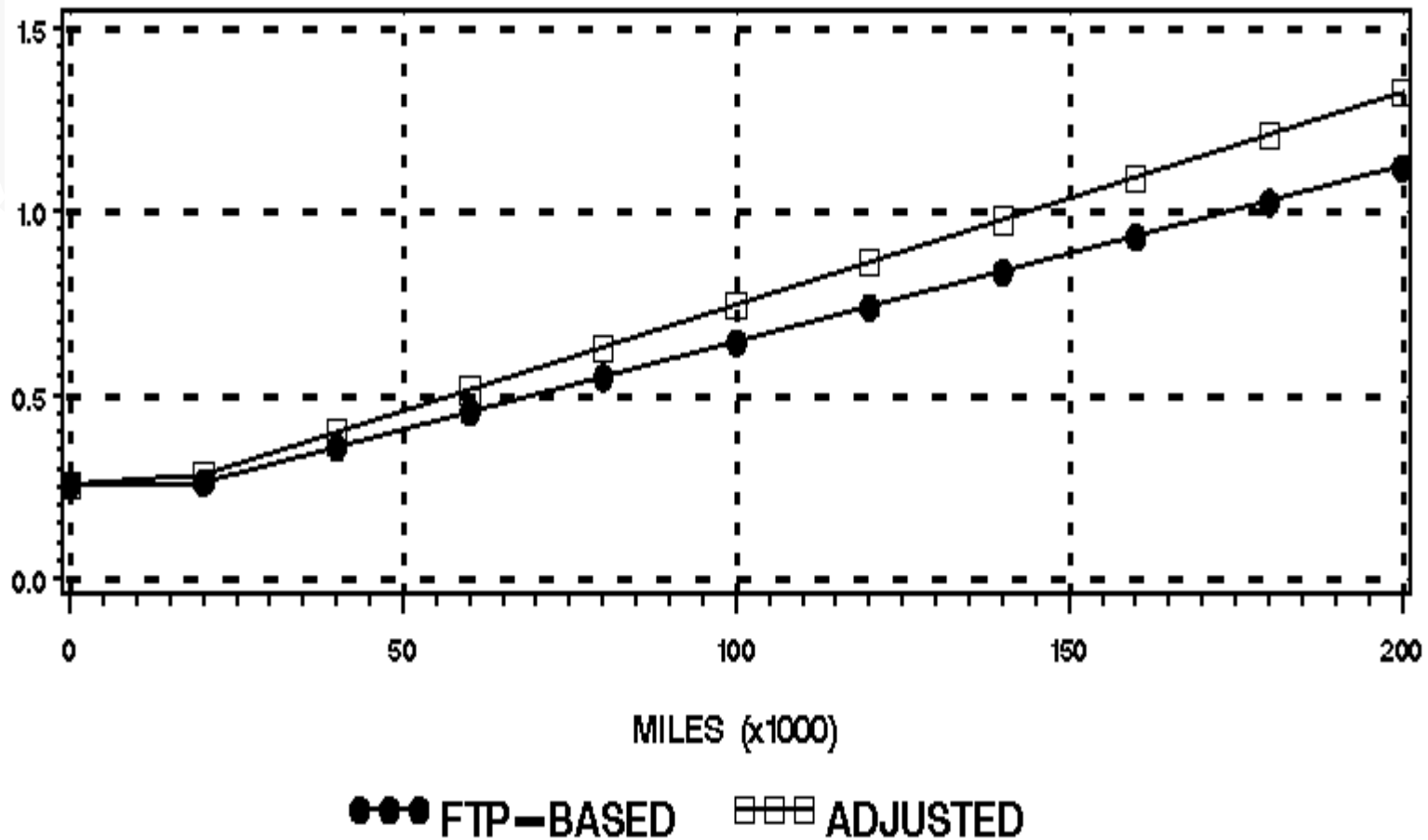
FTP-BASED MOBILE6 PROJECTIONS and OHIO IM240 ADJUSTMENTS  
RUNNING LA4 NOX (g/mi), 1988-93 PFI CARS

NOX (g/mi)



FTP-BASED MOBILE6 PROJECTIONS and OHIO IM240 ADJUSTMENTS  
RUNNING LA4 NOX (g/mi), 1988-93 PFI CARS

NOX (g/mi)



# Final Comments

- ◆ High emitter adjustments to running emissions substantial in some model year/technology groups
- ◆ However, these adjustments are small relative to the overall difference between MOBILE5 and proposed MOBILE6 FTP emissions